ISO TC184/SC4/WG10
Technical Architecture

Issues and topics for discussion

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Introduction

This document presents the issues and topics for discussion gathered at the Sydney meetings of ISO TC184/SC4/WG10, together with the statements provided by members of the Working Group in support of these issues. Section I gathers 59 issues, most of which are accompanied by narrative text provided by the originator of the issue. Section II provides additional material on the topic of "AP Interoperability" provided by WG members who provided input to this discussion at the Sydney meeting.

The contents of this document will be discussed and reviewed at the WG10 meetings to be held in Washington DC on June 24 and June 28, 1995.

I.   Issues and topics for discussion

1.   AP Interoperability

Originator: Julian Fowler

Discussion: A number of issues characterised as "AP Interoperability" have been the subject of discussion within SC4 and its working groups for several years. The failure to develop consensus resolutions to these issues results in the greater part from the fact that this topic covers several separate but related requirements. WG10 has been directed by SC4 to address the issue of AP Interoperability. This activity should include the following tasks.

- Definition and agreement of a statement of requirements for the potential use of ISO 10303 Application Protocols, over and above those that relate to the exchange of product data using conforming implementations of the same Application Protocol.

- Review of the solutions provided within the current architecture, methodology, and capabilities of ISO 10303 with respect to these requirements.

- Development and approval of statements matching requirements to the current capability of STEP.

- Development and approval of statements matching requirements to capabilities that may be developed on the basis of STEP (e.g., through implementation approaches).

- Development and approval of recommendations to SC4 for the development of new or extended capabilities within ISO 10303 and/or other standards.

- Identification of requirements that can not be fulfilled through a product data standard.

2.   Requirements for STEP, P-LIB, MANDATE

Originator: Julian Fowler

Discussion: Requirements statements exist (in some form) for each of the standards developed within SC4. These statements, however, have not been developed as part of a single vision related to SC4's scope of "industrial data". In addition, extant requirements statements for STEP have not been reviewed for several years, and are generally descriptions of the anticipated or desired characteristics of the solution (STEP), rather than the requirements of industry that STEP should address.

WG10 should review the various requirements statements for STEP, P-LIB, and MANDATE, in order to recommend to SC4 a single statement that can serve – through periodic review and update – as the metric for successful integration of SC4's standards.

3.   STEP, P-LIB, MANDATE Architectures

Originator: Julian Fowler

Discussion: ISO 10303 and ISO 13854 each contain and make use of architectures related to data specifications, implementations, etc. These architectures, although fulfilling broadly similar and complementary requirements, are different. Industry's needs to exchange, share, manage and archive product data, libraries of standard parts, and manufacturing data will be facilitated if SC4's standards are either based on a single architecture, or are based on consistent architectures with well defined and understood inter-relationships.

WG10 should address this issue, initially through development of a common, high level of understanding of each of the architectures developed and used within ISO TC184/SC4.

4.   ISO 10303 Architecture & Methodology Reference Manual

Originator: Julian Fowler

Discussion: ISO TC184/SC4/WG5/P1 "Methods" (whose work has been re-assigned to WG10 by SC4 resolution in Sydney) is developing the ISO 10303 Architecture and Methodology Reference Manual (tentatively designated ISO 10303-13). The development of a number sections of this document has been proposed as an assignment to WG10.

WG10 members are invited to contribute to the development and/or review of the ISO 10303 Architecture and Methodology Reference Manual.

5.   EXPRESS edition 2

Originator: Julian Fowler

Discussion: ISO TC184/SC4/WG5/P2 is developing a second edition of the EXPRESS data specification language. WG10 should review the requirements for this second edition, and advise SC4 with respect to the relationship between EXPRESS 2 and the overall scope and requirements of the SC4 standards.

6.   Applications Architecture

Originator: Julian Fowler

Discussion: SC4 offers no specific guidance to projects wishing to develop multiple AP capabilities, either through the parallel development of AP "suites", or by incremental enhancements to STEP's capabilities. This has led to multiple approaches to this problem, including AP suites based on industry-wide activity models and data models (e.g., ship-building), "mega-APs" encompassing many different requirements within an industry sector (e.g., AP214), and approaches based on "frameworks" and "core models".

WG10 should examine the utility and effectiveness of each of these approaches, and determine whether one, consistent approach to the development of AP requirements may be formulated for recommendation and use within SC4.

7.   Requirements for data integration

Originator: Julian Fowler

Discussion: ISO 10303-1 states that "the exchange of information, including storing, transferring, accessing, and archiving" is within the scope of ISO 10303. It also states that STEP is "… suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.". Such statements have led to a widespread understanding amongst the STEP development community, and STEP's customers in industry, that STEP provides standardised support for the sharing of product data through common databases.

However, the architecture and methodology of STEP have been designed to provide for standardised communications (i.e., transactions). The standards produced, while readily adaptable to other uses, are not designed for immediate use in an "integrated data" environment, except as providing the data specifications for communications with or within this environment.

WG10 should develop a consensus understanding of the current capabilities of STEP and of industry's requirements for data integration, and thereby develop recommendations to SC4 and to national standards bodies for the initiation of new work item(s) to address these requirements. Active liaison with standards bodies already working in this field is essential. This liaison should cover industry groupings (such as POSC) as well as ISO and IEC committees.

8.   Relationships to other data standards (SGML, ODA, EDIFACT)

Originator: Julian Fowler

Discussion: Industry's requirements in the domain of "industrial data" cover documents, electronic commerce messages, logistics, technical publications, etc., as well as "product data". SC4 should not develop standards that overlap in scope with other ISO, IEC or industry standardisation efforts. WG10 should take a leading role in ensuring that appropriate integrated, co-operative, multi-standard solutions are available to industry.

9.   Relationships to other language standards (CDIF, KIF, SQL3, ...)

Originator: Julian Fowler

Discussion: The EXPRESS language was developed within SC4 at a time when no effective, system and paradigm independent data specification method was available. However, there are now several other standardisation efforts that are leading to standards with a clear overlap with EXPRESS's current capabilities, and/or with the proposed capabilities of the second edition of EXPRESS.

WG10 should, through appropriate liaisons, recommend to SC4 a strategy for the use of other language standards in fulfilling the requirements of industry and of SC4.

10.   Parametrics

Originator: Julian Fowler

Discussion: A work item on "Parametrics" has been approved by the P-members of SC4. It is not clear from the description of the work item how this work will fit with the existing SC4 standards. WG10 should keep a "watching brief" with respect to the Parametrics work item to ensure that the benefits of this work are applicable, in a generic form, to all the SC4 standards.

11.   How is an architecture documented?

Originator: Phil Kennicott

Discussion: As we discuss architectural issues, it will be important to recognise differences between two architectural proposals. Are the differences are as expected, or are there other, unexpected differences between the two proposals? An early issue will be to decide how to document an architecture in order to best answer this kind of question.

A graphical method for documentation is the first that comes to mind. It is easy for most people to understand and mentally manipulate. We must be careful, however, that we do not allow the elegance of a graphical representation to prevent us from working to the necessary detail. An example of such is the early days of STEP information modelling where it was discovered that graphical methods (e.g., IDEF1X) did not have the detail of EXPRESS.

12.   Multiple, Overlapping Arms in an Application Architecture

Originator: Phil Kennicott

Discussion: When considering the coexistence of STEP with other standards, we will be faced with more than one ARM dealing with essentially the same application information. For example, the information in 210 is nearly the same as the information contained in an EDIF file. If it were possible to read an EDIF file and automatically populate a STEP database with the resulting information, we would have interoperability between the two information representations without either group modifying its standard to accommodate the other group.

For such interoperability to work, we will have to formalise the mapping of an ARM into the AIM and devise methods for converting between two representations of the same information (probably using the formal mapping).

13. Granularity of APs

Originator: Hiroyuki Hiraoka

Discussion: Scope, diversity and volume of information included in an AP differs very much. For example, AP 214: Core Data for Automotive Mechanical Design Process includes various information for automotive design such as shape, product configuration, drawing, material and so on., whereas AP 201: Explicit Draughting focuses only two-dimensional drawing information. System implementors may suffer inefficiencies brought by this difference of granularity of APs.

14.   Placing of APs in larger framework

Originator: Hiroyuki Hiraoka

Discussion: As an AP is made by volunteers who feel it necessary, the scope and size of each AP differs significantly. Arbitrary setting of their scopes would make the later harmonisation difficult. I think APs should be classified and placed clearly in larger framework. There may be several axis or aspects for the classification, but some possible aspects may be

- technologies that is used generally such as draughting and shape representation,

- aspects of product such as mechanical and electrical,

- activities that is a phase in the life cycle of a product such as design and process plans, and

- industries that produces specific product such as automotive and ships.

Such classification would make clear each AP's position and their mutual relations. It may ease the harmonisation between APs and the assignment of their development priorities.

15.   Initiation and creation of new integrated resources.

Originator: Jochen Haenisch

Discussion: Historically the current set of Integrated Resources (IR) was initiated before Application Protocols (AP) came into being. For the final version of the Initial Release the at that time on-going APs had impact on the IRs.

STEP specification work (i.e. ISO 10303) has gradually changed emphasis towards AP development. New AP projects are approved though corresponding IR Parts obviously are not available. This is official policy; the need for IRs shall be triggered from the user needs as stated in the ARMs of APs. This change has many consequences of both technical and managerial nature. Some of them may be worthwhile a statement from WG10.

Related issues are:

- How can be assured that - in spite of maybe arbitrary AP requirements - new IR Parts really develop to cover comprehensively a specific aspect of a product model?

- Do we need a taxonomy of the domain and a task force to administer the growth of the IRs?

- Which architectural elements may reduce the delay in AP development if the AP team has to develop their IRs in addition to their AP?

- Shall we redefine the IRs to be the collection of AIMs? Who does then the generalisation of constructs?

16.   Part 104

Originator: Jochen Haenisch

Discussion: This seems somewhat related (to the previous issue). It is the problem of AP teams not getting the resources that officially are in the program. On the surface this is a managerial issue, but maybe it could be resolved by another model architecture.

17.   Building block approach to APs

Originator: Jochen Haenisch

Discussion: This seems covered by Horst Nowacki's input on item 54.

18.   Clear links with WG5/P1

Originator: Jon Owen

Discussion: WG5/P1 (as was) is charged with an SC4 resolution to document the existing methods. We should, of course, ensure strong contact with that subgroup (which, following its move, should be even stronger!) but also ensure that the areas of work remain distinct: WG10 needs to concentrate on developing the technical architecture(s).

19.   Relationships with any other standards

Originator: Jon Owen

Discussion: By the very nature of its work and the composition of its membership, WG10 has many links with work in other standards' committees (both within TC184/SC4 and outside). Other colleagues have indicated particular areas where we need to build and strengthen existing relationships: I believe that we must cast our net very wide, in order to benefit from the efforts of others. We should not restrict ourselves to "just" language or product data standards: there are plenty of other relevant initiatives and existing standards. In this way, we can provide stimulus for our own and other working groups within SC4, and the ensuing technical direction. For example, several conformance testing standards have been published over the last few years: some have benefited from the work of others; some have not. Equally, there is work from which the Express group can benefit in its discussions on "process".

20.   Whatever we do, the requirements should be documented up front.

Originator: Jon Owen

Discussion: For every work item we address, we should determine and document the requirements. This will provide both a rationale for undertaking the work and what is to be achieved. It will also enable us to measure our progress. This will mean that all members of the group (and those outside it) will understand why we are addressing a particular issue. It will also help in determining our priorities (put bluntly: what (problem, deliverables), why, how much/far). This last item is really a high-level requirement that should apply to all of the others, when we choose to address them.

21.   Strategy for direction of SC4 standards, including identification of missing components

Originator: Nigel Shaw

Discussion: With the possible exception of the SPAG, there has been no group responsible for defining a strategy for the standards under SC4. Currently we see topics split (or duplicated) across different WGs that merit a single focus while some topics fall between the groups or fail to be given sufficient priority. It is essential that a strategy is defined which ensures that:

- The existing SC4 standards are compatible in usage and not just technology

- The relationships to other (standards) developments are actively taken into account.

I believe this is a technical task which should naturally fall under the remit of WG10. It is also vital to document such a strategy to ensure review and buy-in.

22.   SWOT analysis of existing STEP, PLIB and MANDATE standards and approaches.

Originator: Nigel Shaw

Discussion: (SWOT stands for Strengths, Weaknesses, Opportunities, Threats)

WG10 has been created at a late stage and is faced with a considerable body of existing work. The architecture which it creates has to be based on that work to some (significant) extent. It is therefore appropriate to analyse what has been created (and, to a lesser extent, done) for good and bad points. This should do the following:

- Identify each existing architectural component.

- Document a short description of the component and its current role (to avoid ambiguity).

- Review component for strengths and weaknesses based on current usage

- Determine its applicability and relevance to other standards (Opportunities)

- Review any problems and possible or practical alternatives (Threats)

This review should form a baseline for WG10's work.

It is recommended that a sub-group undertake this task with limited membership but with all three current SC4 developments represented.

23.   Document assumptions

Originator: Nigel Shaw

Discussion: Underlying the STEP development are a series of assumptions which are not all clearly understood. I assume(!) the same is true of PLIB and MANDATE. These assumptions should be documented, reviewed and agreed.

To illustrate the point:

Assumption: It is possible to provide a (fixed) conceptual schema for product data.

Assumption: It is always appropriate to maximise the intelligence preserved across an exchange of data.

Assumption: EXPRESS can be made implementation form independent.

Assumption: EXPRESS can pretend that the accuracy of all arithmetic is perfect.

Assumption: It is necessary and appropriate for STEP to be an ISO Standard.

24.   Requirements for non-ISO standard classifications

Originator: Nigel Shaw

Discussion: Many of the STEP application protocols contain attributes defined to be STRINGs. In practice however a particular industry, nation, association or project will have a fixed enumerations of values which will be used. Currently the STEP approach renders these values non-computer sensible without going beyond the standard and provides no support. In order to support the way business really works and avoid one of the pitfalls encountered by EDIFACT and X12, an approach should be included which enables classifications and other configurations of data to be supported.

25.   Mechanisms for business rules

Originator: Nigel Shaw

Discussion: See also 24. There is no support in the existing approaches to enable the support of rules defining the allowed combinations of data that apply in a given situation (industry, nation, association or project). By definition an ISO standard often cannot get into the specific requirements but it can offer mechanisms to let others do so.

26.   Requirements for testing that goes beyond conformance

Originator: Nigel Shaw

Discussion: The formally documented view of testing (within STEP) is limited to conformance testing. The following list gives some other forms of testing:

Robustness, acceptance, efficiency, interoperability

Given that interest from users is often in other forms of testing than conformance, to what extent and how should these be supported?

27.   What is expected of something (systems and data) to be "STEP-based"?

Originator: Nigel Shaw

Discussion: STEP does not provide a fixed implementation architecture but instead provides a technology and components which may (or may not) be used within an implementation. Is there a base level of commonality which should be common to all STEP implementations? Does it make sense to ask the same question of all "SC4-Standard" implementations?

This is related to number 23. Some level of commonality is being assumed. What is the level and is this a valid assumption?

28.   What is an architecture?

Originator: Jim Fulton

Discussion:

29.   How do SC4 products fit into an enterprise architecture?

Originator: Jim Fulton

Discussion:

30.   Level 4 knowledge exchange.

Originator: Jim Fulton

Discussion:

31.   Adequacy of documentation of methods and architecture

Originator: Mark Palmer

Discussion: The SC4 projects have often been hindered by a lack of comprehensive and understandable documentation. The methods and processes used for developing SC4 standards must be sufficiently well documented for training new members of SC4 projects and for educating users about the SC4 standards.

Overviews on the methods, architectures across the SC4 standards, and the use of SC4 standards will be needed. As part of the evaluation of the SC4 architecture, WG10 will require metrics for assessing the adequacy of this documentation.

32.   Adequacy of infrastructure (e.g., QM procedures, testing, and tools) for the delivery of useful standards

Originator: Mark Palmer

Discussion: Related to #31. The delivery and maintenance of SC4 standards is surviving with a fragile network of people, procedures, and tools. The quality management, testing, and process improvement functions for the delivery of SC4 standards and for improving SC4 standards should become active across SC4 projects. Mechanisms should be established for ensuring that SC4 projects are knowledgeable of the best tools and most effective processes for delivering the needed standards.

33.   Adequacy of tools to support …

Originator: Mark Palmer

Discussion: combined into #32.

34.   Relationship to WG4 and Implementors Forum

Originator: Mark Palmer

Discussion: WG10's relationships to all the WGs and Implementor Forums should be analysed, and the recommended types of interactions should be documented. This should be done in the context of updating the SC4 and STEP Development Process models and RASI (Review, Approve, Support, Implement) tables.

35.   Guidance on modelling methods and planning frameworks

Originator: Mark Palmer

Discussion: Many SC4 projects would benefit from guidance on: selecting and applying planning frameworks, modelling practices, and defining scope boundaries and testing scenarios. This guidance supplements the formal documentation on methods.

This issue is not relevant to the WG10 at this time.

36.   Architecture Primer for internal and external customers

Originator: Mark Palmer

Discussion: Related to #31. The architectures of the different SC4 standards are not well understood by all participants in the SC4 projects. Additionally, easily understood, introductory explanations of these architectures are needed to properly inform and educate industry and potential users of the SC4 standards.

WG10 should develop these primers or ensure that such primers are developed and maintained as the architectures of the SC4 standards mature.

37.   Why an architecture?

Originator: Paul Clements

Discussion:

38.   Co-operative Usage of Standards

Originator: Bernd Wenzel

Discussion: Some people in the STEP community still believe, that the first commandment for STEP developers and users reads like: Thou shalt not have any other standard besides me!. This is a ridiculous nonsense. STEP is not, and will never be the mother of all standards. It is therefore essential, that STEP developers start recognising that other standards such as SGML, EDI, MMS, and others do exist, have a right to exist on their own, and could make STEP even more useful if we learn how to combine the functionality of STEP with the functionality of one or more other standard.

STEP has to provide an architectural framework, which allows to use multiple standards in a combined way, independent of who has actually developed those standards. The fact that we are currently distinguishing between

- AP-interoperability, the co-operative usage of standards developed within the STEP project,

- harmonisation of SC4-standards, the co-operative usage of standards developed within ISO TC184/SC4, and

- co-operative usage of arbitrary standards,

is conceptually not really helpful. We should rather recognise our obligation to be co-operative with any standard the STEP users may wish to use in combination with STEP, and set up an architectural framework accordingly. This does neither mean that we have to use the same technical means to solve all problems of this class, nor that we have to solve all problems of this class at the same time. We should rather approach the problems inside out, that means, first the STEP internal problems, then the one within the SC4 organisation, and finally the general ones, but always with knowledge and consideration of outer problem domains.

39.   Knowledge of and response to users' needs

Originator: Bernd Wenzel

Discussion: A key issue of the development of STEP so far was the lack of knowledge of, and an intolerably low priority for the user needs.[1] Co-operative usage of standards, as explained in the previous section, is just a good example of such needs. The whole development of STEP must be guided by the understanding and even anticipation of those needs, rather than by what can be implemented cheaply and easily today.

We must understand, that the only reason for SC4 and its WGs to exist is, that there is a global industrial need for the communication of product and process data. If SC4 does not take that into account, it will cease to exist. As long as it watches those needs carefully and proves itself to be responsive to them, it will have a bright future. In other words, SC4 can be seen as an economic organisation, that will flourish as long as its services add some value to its customers activities, but not longer.

CAD vendors or STEP implementors may object, that there are of course economic limitations to what I've said above. This is true, but we should not underestimate the value added by a standard such as STEP in an industrial environment, where virtual enterprise and enterprise integration are the buzzwords of the day. We should rather accept, that a solution to a problem is economically useful, as long as it costs less money than the unsolved problem. This means at least for some industries not less than just the existence of this industry.

This section is not intended to blame the implementors to be responsible for the inadequacies of the initial release of STEP. It is much more a call for a more courageous approach to standardisation. We need to investigate and understand the user needs, and then develop the standard proactively, so that the standard solution to a problem is available when the majority of the users realises this problem and starts to require its solution.[2]

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[1] The term user needs has been used here by intention. We really need to understand what the users need, and even will need in the future, rather than what the users have already realised and can therefore state as their respective. requirements.

[2] We will of course make mistakes, this means that our prophecies will not always be right. But with the competence we have together in the STEP project we should be able to minimise the risk down to a level, where we can deal with it in an economical way.

This approach will win us the support of the more innovative CAx vendors in the future too, as they will realise the competitive advantage of this type of analysis and/or control of their future market place.

40.   Team Building

Originator: Bernd Wenzel

Discussion: The older the SC4 projects grew, the less have SC4 and its WGs acted as a team. Today you'll find a lot of we versus they and no more we versus others of us. This is a typical symptom of disintegration that must be fought heavily, if we want to secure the long-term success of as complex things as STEP and other SC4 standards. We cannot blame other organisations inside and outside ISO of not being able to co-operate with us, if we can see the same symptom between the various WGs within SC4, and even between different projects in one and the same WG.

WG10 has adopted a policy to become a prototype of a new team culture within SC4. It is WG10's intention to showcase the feasibility of this team culture and to export it into all WGs in SC4, and maybe even beyond.

41.   Criteria that assist SC4 and P-Members in approving new projects

Originator: Yuhwei Yang

Discussion:

42.   Establishment formal relationships with ALL WGs and projects

Originator: Yuhwei Yang

Discussion:

43.   Education/training/communication

Originator: Yuhwei Yang

Discussion:

44.   How is the Quality of the SC4 Standards Assessed?

Originator: Martin Hardwick

Discussion: The current evaluation process for the SC4 standard requires each country to ballot each standard in several stages. At each stage we judge the quality of the standard by the votes of each country and by the number of ballot comments received.

If too few comments are received then we might conclude that there is insufficient interest in this item and you can argue that it should not continue on its progress towards a standard. If a great many comments are received then we might conclude that many projects are evaluating this item and you can argue that it should progress towards a standard. However, counter arguments can be made to the effect that fewer comments mean that the standard has more quality and more comments mean that the standard has less quality.

A lot depends on the interest in the member countries on a standard. The best standard might be one for which there is intense interest and evaluation by the member countries and only a few comments because it is so good.

So far AP203 and AP201 have become full standards. AP203 received intense evaluation in the US and I am confident that it is a good standard because of this scrutiny. I am less confident about AP201 but willing to believe that this is because of my background and interests.

If WG10 has a role in judging the standards, then how will we make these judgements as more and more standards are produced? For example, should we ask each voting country if they have evaluated a standard in a pilot project, or if they have performed a paper study only?

45.   How is the Scope of the SC4 standard determined?

Originator: Martin Hardwick

Discussion: This is closely related to the previous issue and most easily described with reference to EXPRESS. We could define extensions to EXPRESS to cover any problem that we find in STEP. EXPRESS-C. EXPRESS-M, EXPRESS-P and EXPRESS-V have already been proposed. We need to limit our scope and use external standards whenever possible. How do we determine when an external standard is available and (more importantly) when it is sufficiently suited to our task to make the effort of producing a new standard not worthwhile.

46.   Fit of STEP/P-LIB/MANDATE.

Originator: Matthew West

Discussion: It is not clear how STEP, P-LIB and MANDATE work together

47.   What is a core model and where does one fit in the architecture?

Originator: Matthew West

Discussion: There is increasing interest in data models that define common semantics for an industry, or across industries. There does not appear to be an obvious place for these models which seem to fall somewhere between Resources, AICs and ARMs.

48.   Document Quality - clarity of requirements

Originator: Matthew West

Discussion: There is insufficient clarity/availability of the quality requirements for the documentation of APs

49.   Identify and understand underlying principles of the architectures

Originator: Matthew West

Discussion: An architecture is much easier to create and maintain when the principles which drive its creation are explicit. It makes the architecture "open".

50. Effectiveness and utility of results

Originator: Matthew West

Discussion: Standards have no value unless they are used. We should establish criteria by which utility can be measured, and then do so.

51. Efficiency of process

Originator: Matthew West

Discussion: We need to be sure the deliverables of the methodology have a value (i.e., are necessary) and that the activities add value to the deliverables justified by their cost. I.e., we don't just do things because we do them.

52. Roles and relationship of elements within the architecture

Originator: Felix Metzger

Discussion:

53. Efficiency of work of WG10 - technical discussion

Originator: Felix Metzger

Discussion:

54. Modular, flexible structures within the ARM

Originator: Horst Nowacki

Discussion: Currently an ARM is structured by Application Objects (as primitives) and Units of Functionalities (as the only level of aggregation). This is a rigid structure, not flexible enough to describe the intended, often more complex relationship between modular information aggregation in the ARM. In particular it is not readily possible to build "classes of aggregates" that belong together for usage scenarios. These multiple usage scenarios must be designed into the ARM.

Neither the conformance classes nor the AICs, which are eventually defined at AIM level structure requirement. They are defined too late and from different requirements than the aggregations needed at ARM development time.

A POSSIBLE SOLUTION should at least allow for the following distinction:

- Application objects (primitives)

- Basic aggregates (low level, small granularity aggregates)

- Complex aggregates (built from basic aggregates and perhaps further application objects)

This pattern would enable ARM developers to build up usage scenario aggregates within the same ARM or across several APs. Thereby it is facilitated to identify intended conformance class sets for

the AIM development team. The result would be equivalent to a "schema-like" structure at ARM level.

55.   Architecture, methods and procedures need to be consistent and supported by SC4

Originator: Julian Fowler

Discussion: It is insufficient for the architecture(s), methods and procedures used in the development of the SC4 standards to be approved by those responsible for their development. It is clear from many discussions within the SC4 Working Groups that their is little understanding, much less acceptance, of the current STEP Architecture and Methodology.

WG10 should work with its Methods Documentation project (WG10/P1), the Quality Teams proposed by the PPC, and SC4 to facilitate the acceptance and use of consistent architectures, methods and procedures for all SC4 standards.

56.   Breaking the closet mentality.

Originator: Nigel Shaw

Discussion: The current STEP architecture provides (through APs) a way for groups to come to SC4 to define what in effect is a specialisation of STEP to meet their needs. This encourages them to work in isolation, often on an funded project which has already committed to deliver a specialist AP. This partially accounts for the growth in the number and scope of STEP APs. In a similar fashion, the existence of EXPRESS lets the subject of implementations be dealt with in isolation. In neither case is this isolation always helpful.

I accept (as was stated in Sydney) that this can be viewed as a management problem rather than technical. However, I believe it is a direct consequence of the current architecture and any future architectural approach should consider the organisational and related consequences.

(Note: This is a specific case of the Strengths and Weaknesses of an architectural component, i.e. APs. See topic 22.)

57.   What guidance should be given to projects to govern their relationships to the rest of SC4

Originator: Julian Fowler

Discussion: New projects joining or wishing to join are provided with little or no information describing their relationship with other functions within SC4. This includes the requirement on AP projects to support QIE functions, but also covers the relationships between AP projects, between AP projects and Working Groups, etc.

WG10 should work with the PPC and SC4 to ensure that the responsibilities of projects within the SC4 organisation are defined.

58.   SPAG resolution 222.

Originator: Bernd Wenzel

Discussion: Resolution 221: SC4 approves the requirement for an SC4 strategic policy on Application Protocols as set forth in the following SPAG document N124 "Requirements for a SC4 Strategic Policy on Application Protocols" dated 10/20/94.

Resolution 222: SC4 directs the Architecture WG to propose realistic strategic policy alternative solutions to the requirements defined in SPAG document N124.

59.   Relationship between ISO 10303 and ISO 13584

Originator: Guy Pierra

Discussion: I saw that in Sydney, the problem of the relationships between ISO 10303 and 13584 was not discussed. I see three kind of related problems:

- sharing of resources: use of resource constructs defined in 13584 within some 10303 APs (and more generally, use of resources constructs define outside 10303 within 10303)

- level 1 interoperability: reference from a product data model to parts or part representation defined by a 13584 (raise some issues about the 10303-41 definition of a product that can't be defined independently of an 10303 AP)

- Level 3 interoperability: gathering in the same repository (e. g. physical file) of

  - 13584 conforming part classes and/or representation classes.

  - 10303 conforming product data that references these classes (this capability seems to be required in particular in AEC).

II.   AP Interoperability

1.   The Shipbuilding Situation

Markus Lehne, Vulkan Schiffbau Verbund

The approach of defining for each engineering discipline a separate AP is based on the traditional way of designing a complex product like a ship (by dividing a big problem into many small ones and providing small solutions) and thus it is intended to provide means for the descriptions of all aspects of all life cycle phases of the entire ship.

The Shipbuilding Community has currently 5 APs under Development:

215 Ship Arrangements, 216 Ship Moulded Forms, 217 Ship Piping, 218 Ship Structures and 226 Ship Mechanical Systems. And many more are in the pipeline (HVAC, Electrical, Accommodation, Mission...)

But with each set of APs you have the same problem as with the many small problems and their related solutions, they have to be put together to form a consistent whole in the end.

Besides that many of the usage scenarios are of course linking the different engineering disciplines and thus AP boarders are not matching usage scenario borders (and never will, independent of their partition).

Therefore a requirement for a consistent, modular set of APs is a Product Model on ARM level which comprises all the APs mentioned above, as a superset of all AP s for that particular industry, which allow for each individual exchange scenario to derive an adequate AP, or subsets of them, or intersections of AP subsets, for its interface definition.

This means that modules of that product model will be reused in many APs.

The modules building that ARM Product Model have to be mapped onto the resources in a way which allows their (free) configuration for the interface definition mentioned above.

A pre-integrated, modularised model would be the approach to make that possible.

2.   Some Aspects of AP-Interoperability

Bernd G. Wenzel, EuroSTEP GmbH

2.1.   Introduction

This is a written summary of an ad-hoc presentation on the problem of AP-interoperability, given on 22-Mar-1995 for the STEP Architecture WG. As it was just one of a series of similar presentations by others, it is rather a collection of additional thoughts, not covered by the presentations before, than a full description of the issue and the related problems.

2.2.   Term

First it must be stated, the term AP-interoperability is rather inadequate. The term interoperability is defined as the capability of two systems to achieve a useful result together by exchanging some kinds of messages. APs are neither systems, nor do they communicate. What the term really means is the capability of two systems which are based on different APs to communicate with each other in a reasonable, controlled, and predictable way.

Therefore the term co-operative usage of APs seems much more appropriate.

2.3.   Industrial Need

In contrast to the design assumptions for the current STEP methodology, that neither any vendor nor any user of STEP might ever be interested in using the full domain of al STEP information models, it has become clear in the meantime, that just this is the case. Based on statements made at the workshop and on my own experience as consultant I can state, that at least the following organisations have declared their needs for the full and unrestricted power of STEP:

•   US Department of Energy

•   Boeing (Aerospace)

•   Bremer Vulkan (Ship Building)

•   Shell (Process Industry)

•   Swedish National Road Administration

•   Volvo and BMW (Automotive)

Therefore, we can state, that the co-operative usage of standards represents a major problem for most if not all big companies, irrespective of the particular industry segment. It can be expected in addition, that this need will grow rapidly in the near to mid-term future.

2.4.   Classes of Co-operative Usage of Standards

In the past, two classes of co-operative usage of standards have been introduced, union- and intersection-co-operative usage. The first one was covered only briefly in the presentation. For the second two distinct subclasses were defined. A third one based on the mathematical concept of a cross-product was introduced.

2.4.1.   Union-Based Co-operative Usage of Standards

This is the case, where the information base is described by the union of two or more information models. It was agreed, that this is the most important case for the time being.

2.4.2.   Intersection-Based Co-operative Usage of Standards

This is the case, where an application conforming to one standard filters out whatever is useful and usable from data conforming to a different standard. The following two subclasses of this case should be distinguished because of the different technical requirements for their respective. implementation:

Intersection-Based Co-operative Usage of Standards involving two Schemas

This is the case, where an application conforming to one standard filters out whatever is useful and usable from data conforming to a different standard, making use of the schemas describing either standard.

The main implementation requirements to achieve this are:

- a way to recognise the overlapping areas of two different schemas

- a software architecture allowing for the usage of arbitrary schemas describing the data to be read.

Intersection-Based Co-operative Usage of Standards involving a single Schema

This is the case, where an application conforming to one standard filters out whatever is useful and usable from data conforming to a different standard, without any knowledge of the schema to which the sending system conforms.

The main implementation requirements to achieve this are:

- complete integration of the schemas describing both systems

- application of the identical encoding technique on either side.

2.4.3.   Cross-Product-Based Co-operative Usage of Standards

This is a new aspect of co-operative usage of standards, which has never before been discussed, at least not within the organisation of STEP or SC4. Its objective is to create single objects that conform

to multiple standards at the same time, e.g., different orthogonal functionalities. To understand better what that means, lets look at an example.

Lets assume that we have 2 orthogonal schemas, one for geometric modelling and one for version control. The mechanism described here would now allow to implement version controlled geometric design. In an oversimplification, it would do this by creating implicitly a third schema, in which all entities are subtypes of one entity in the geometric modelling schema and one entity from the version control schema.

This is admittedly by far not sufficient. A whole lot of work has to be done, before we really understand the power as well as the limitations of this proposal. But it looks rather tempting at first and should therefore be investigated a bit further. It should also be noted, that this technique is already being used for STEP implicitly: the mechanism by which part 21 adds the scope concept to potentially every instance can formally be described as the formation of a cross-product between any arbitrary schema and the one defined below.

*)

```
SCHEMA part21;

  ENTITY part21_instance;
    id             : INTEGER;
  END_ENTITY;

  ENTITY scope_owner
  SUBTYPE OF (part21_instance);
  INVERSE
    members        : SET [1 : ?] OF scope_member FOR owner;
  END_ENTITY;

  ENTITY scope_member
  SUBTYPE OF (part21_instance);
    owner          : scope_owner;
  END_ENTITY;

END_SCHEMA;
```

(*

This EXPRESS model is ignoring the export list of part 21. A version of the above model treating the export list correctly should be added to part 21.

3.   AP Interoperability - Problem Or Symptom

Matthew West - Shell International Petroleum Company

I would like to suggest that the AP Interoperability issue is a symptom that there are wider requirements that industry has, than STEP is addressing. That the current STEP methodology addresses some industry requirements well, but does not currently address the wider problem. And that it is important to understand the broader requirement and then provide an appropriate solution, rather than fix the current methodology for each new symptom of the broader requirement.

At the heart of any companies information is data about the structure of the business. This is data about:

   •   Products

- Processes

- Assets

- Organisation (internal and business partners)

This data drives three large pools of information:

- Descriptions of the elements of the business structure (data sheets, drawings, documents)

- Business Operations - financial, procurement, sales, operations, maintenance (transactions)

- Management Information - mostly summaries of the business operations

In addition the same information is used widely in a number of different activities. For particular activities we have found that as much as 90% of the information is used in other activities.

Thus the broader industry requirement is for what I will call Data Integration. This means being able to have a single consistent view of an enterprises information (shared with business partners). Logically there would be a single source for data.

The current STEP methodology does a good job of enabling exchange and management of coherent data sets. This is an important part of what is required to satisfy the overall requirement I have outlined above.

However, using the pipes (APs) and tanks analogy that Felix introduced, it only deals with the pipes. We need to deal with the tank too. Just as it is possible to modify the design of a pipe until it becomes a tank, it is not the best way to proceed. I suggest we design a tank to work with the pipes. Some key requirements for the tank include:

- the ability to hold complete lifetime data for products and assets

- the ability to hold "work in progress" data (i.e. incomplete data).